

CLAIMS

1. Apparatus for transferring data from a host computing system to one or more magnetic
5 tape storage devices or the like, the apparatus comprising input apparatus for receiving
data, dividing it into blocks, and converting said blocks of data to a format suitable for
storage on said one or more storage devices, one or more data writers for writing said
blocks of data in sets of a plurality of blocks to said one or more storage devices, one
0 or more data readers for reading back data written to said one or more storage devices
and transferring said read data to error checking apparatus, said error checking
apparatus being arranged to generate a negative output only if a block of data includes
an error and/or more than a predetermined number of errors, and control apparatus for
causing said one or more data writers to rewrite a set of blocks of data to said one or
5 more storage devices in response to a negative output from said error checking
apparatus, until all of the blocks of data in that set are written without error (or with
fewer than a predetermined number of errors) during the same rewrite.
2. Apparatus according to claim 1, wherein data is written to the one or more storage
10 devices in codeword quad (or CQ) sets comprising an array, of ECC encoded
codeword pairs.
3. Apparatus according to claim 2, comprising a history store for storing information
relating to at least some of the CQ sets written to the one or more storage devices
together with information corresponding to the output of the error checking apparatus
25 for each codeword pair of the set.
4. Apparatus according to claim 3, wherein each CQ set is identified in the history store
by a plurality of bits of data, including at least two row quality bits per codeword pair

5. Apparatus according to claim 4, wherein the row quality bits for each codeword pair are both set to 0 when a CQ set is first written to the one or more storage devices.

5 6. Apparatus according to claim 5, including detection apparatus for determining whether the header of a read codeword pair is correct and, if so, whether each codeword is good or bad, depending on the number of errors they contain, the apparatus further comprising apparatus for setting the row quality bits to indicate the result of such error checking.

0 7. Apparatus according to claim 6, wherein the row quality bits are set to 00 if the header of the codeword pair is corrupted (so that the codeword pair cannot be identified), 01 if the header is correct but both codewords are bad, 10 if the header is correct but only one of the codewords is good, and 11 if the header is correct and both codewords are good.

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10 8. Apparatus according to any one of the preceding claims, comprising a plurality of tracks by means of which a number of blocks of data are simultaneously written across said one or more storage devices.

20 9. Apparatus according to claim 8, wherein said error checking apparatus comprises a number of parallel read heads for simultaneously reading back a number of blocks of data written to said one or more storage devices.

25 10. Apparatus according to claim 8, comprising eight parallel tracks.

11. Apparatus according to claim 9, comprising eight parallel read heads.

30 12. Apparatus according to claim 1, wherein said at least one data reader is positioned such that it follows said at least one data writer and is arranged to read back data just written to said one or more storage devices, whilst data is still being written to said one or more storage devices.

13. Apparatus according to claim 1 of the preceding claims, including a control register having 1 or more (and more preferably 4) bits which can be set by a user to cause a set of blocks of data or CQ set to always be rewritten unless all of its blocks of data or codewords are good (i.e. do not result in a negative output from the error checking means), regardless of previous rewrites.

14. A method of transferring data from a host computing system to one or more magnetic tape storage devices or the like, the method comprising the steps of receiving data and dividing it into blocks, converting said blocks of data to a format suitable for storage on said one or more storage devices, writing said blocks of data in sets of a plurality of blocks to said one or more storage devices, reading back data written to said one or more storage devices and transferring said read data to error checking apparatus, said error checking apparatus being arranged to generate a negative output if a block of data includes an error and/or more than a predetermined number of errors, and rewriting a set of blocks of data to said one or more devices in response to a negative output from said error checking apparatus until all of the blocks of data in that set are written without error (or with fewer than a predetermined number of errors) during the same rewrite.

15. A method according to claim 14, including the step of writing the data to the tape in codeword quad (or CQ) sets comprising an array, of ECC encoded codeword pairs.

16. A method according to claim 15, further comprising the step of storing in a history store information relating to at least some of the CQ sets written to the one or more storage devices together with information corresponding to the output of the error checking apparatus for each codeword pair of the set.

17. A method according to claim 16, further comprising the step of identifying each CQ set in the history store by a plurality of bits of data, comprising at least two 1 valid bit, 32 row quality bits per codeword pair.

18. A method according to claim 17, further comprising the step of setting both of the row quality bits for each codeword pair to 0 when a CQ set is first written to the one or more storage devices.

19. A method according to claim 18, further comprising the steps of determining whether the header of a read codeword pair is correct and, if so, whether each codeword is good or bad, depending on the number of errors they contain, and setting the row quality bits to indicate the result of such error checking.

20. A method according to claim 19, wherein the row quality bits are set to 00 if the header of the codeword pair is corrupted (so that the codeword pair cannot be identified), 01 if the header is correct but both codewords are bad, 10 if the header is correct but only one of the codewords is good, and 11 if the header is correct and both codewords are good.

21. A method according to claim 14, further comprising the step of providing a control register including 1 or more (and more preferably 4) bits which can be set by a user to cause a set of blocks of data or CQ set to always be rewritten unless all of its blocks of data or codewords are good (i.e. do not result in a negative output from the error checking means), regardless of previous rewrites.